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Friends in the classroom: a comparison between two methods for the assessment of students' friendship networks

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Abstract One of the methods used most often to assess students' friendships and friendship networks is the reciprocal nomination method. However, an often heard complaint is that this technique produces rather negative outcomes. This study compares the reciprocal nomination method with another method to assess students' friendships and friendship networks: Social Cognitive Mapping (SCM). The outcomes show that descriptions of students' friendships and friendship networks by both methods tend largely to overlap, even though SCM divides the students into smaller groups. The nomination method indeed yields a slightly more negative picture, labeling more students as "isolates". According to students, in most cases the group structure of SCM best reflects reality, whereas more than half of the teachers consider the nomination structure to best fit with reality. It is concluded that the differences between both methods are small, which seems to be primarily based on rather arbitrary decisions in the programs calculating students' scores and group composition.

Keywords Friendship · Friendship networks · Primary education · Students

1 Introduction

Friendships and peer relations are important in the lives of children. The benefits of friendships on psychological and physical health have been well documented ([Male](#)

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2007). Having friends is associated with enhanced opportunities to exercise behaviors and acquire skills related to social, emotional and cognitive growth (Newcomb and Bagwell 1996). In addition, having friends in the classroom appears to be an important source of companionship and emotional support (Ladd 1990), which might facilitate students' ability to cope with the challenging demands of school (Leung and Silberling 2006). Having friends also seems to have a protective effect. For instance, Newcomb and Bagwell (1996) state that having at least one friend in class may serve as a buffer against the negative effects associated with low peer acceptance. This is especially important for low-performing students and students with special needs, since research has repeatedly shown that such students are less accepted than their typically developing peers (Buysse et al. 2002; Guralnick et al. 2007; Pearl et al. 1998; Williams and Asher 1992). But typical peers can also experience a lack of acceptance and isolation in school settings (Pijl et al. 2008; Koster et al. 2010).

The establishment of friendships between students is viewed as an important indicator for the social participation of students in class (Davis et al. 2002; Hunt et al. 1996; Juvonen and Bear 1992). According to Cullinan et al. (1992), having at least one mutual friendship is a sign of social participation. In addition to dyadic friendships, several researchers emphasize the importance of examining membership of cohesive friendship networks (Farmer and Farmer 1996; Yugar and Shapiro 2001). According to Kindermann (1993), children's peer social networks provide distinctive and important contexts for individual development. Frequent contact and common activities combined with interpersonal connectedness may make children's friendship networks a strong socializing force in the classroom. The above makes clear that friendships between students are important in education. Because of the positive effects of having friends and the negative effects of being lonely, it is crucial to monitor students' friendships and memberships of peer networks.

Various techniques have been used to analyze students' friendships and social networks in classrooms. One of the most frequently used methods for this is the reciprocal nomination method. This invites each child in a classroom to nominate a small number of peers, usually three, whom he or she likes most (Jiang and Cillessen 2005). The most common forms of nomination questions include direct-preference questions with a positive and/or negative phrasing (e.g. "name three classmates you like most/least") and task-specific or indirect-preference questions (e.g. "name three classmates you like/don't like to play with") (Hymel et al. 2002). The positive nominations make it possible to assess students' numbers of friendships and to identify subgroups of students (Richards 1995). Many regard the negative forms as unethical and exempt these versions.

An often-heard complaint is that the nomination technique provides outcomes that are too negative (Chambers and Kay 1992), or which do not capture the totality of an individual's peer affiliations, particularly in a school setting (Farmer et al. 2003; Pearl et al. 1998). Social Cognitive Mapping (SCM) procedures have been developed to overcome these limitations and to identify peer groups in school settings (Farmer et al. 2003). With SCM procedures, students are asked to identify groups of peers who hang out together. They are encouraged to name as many groups or social clusters as they can, but are not required to categorize every classmate into a social cluster (Gest 2006; Gest et al. 2003). This SCM method results in a description of each

student's peer affiliations based on the general consensus of all available classmates. Both methods are thought to yield different types of results, since students answering the nomination question will probably nominate the classmates they like at that particular moment. In answering the SCM question, students have to recall who in class hangs out with whom, an answer which will probably be less susceptible to incidents that just happen and to daily issues.

To summarize, the nomination method is often used to assess students' friendships in the classroom, but its outcomes have been questioned. SCM might be an alternative, yielding more valid outcomes. Resulting from the above, the following research question is central in this study.

Is Social Cognitive Mapping a more valid technique to analyze students' friendships at school compared to reciprocal nomination?

2 Method

2.1 Design

A comparison will be made between two methods for assessing students' friendship networks: reciprocal nomination and SCM. The results of both methods will be compared to the number of students labeled "isolates", the number of friends students have and the number and composition of the cohesive subgroups in class. The face validity of both methods will be described by inviting a panel consisting of students and one consisting of teachers to assess the number and composition of the cohesive subgroups in class.

2.2 Participants

Nine regular Dutch primary schools were invited to participate in the study. The choice of schools can be described as a "convenience" sample. The schools were located at a reasonable travelling distance from the authors who were responsible for data gathering. The small sample fits in well with first small-scale experimenting, but it seriously limits the generalization of findings.

All schools agreed to participate: the actual sample consisted of 9–11 year olds in grade 4 of school. This age category is assumed to be able to complete a questionnaire adequately and is less likely to be influenced by day-to-day developments in reporting on friendships than younger students (De Monchy et al. 2004). All parents of the pupils in the participating classes were informed about the study by mail. Children would not have been included in the study if parents had not wanted their child to participate. None of the parents objected.

The definitive sample comprised 190 fourth-grade students. The average class size was 21.1 students ($SD = 4.4$), with a minimum of 13 students and a maximum of 25 per class.

2.3 Instruments

In order to assess students' friendships and friendship networks, two methods were used. The first, the *reciprocal nomination method*, required children to name classmates who fitted a particular sociometric criterion (Larrivee and Horne 1991). This method has been used to assess the friendships of children of various ages. It has been adopted in the literature as the primary method for assessing friendship (Yugar and Shapiro 2001). All students in the nine participating classes were asked to nominate the classmates they considered to be their best friends. Following Frostad and Pijl (2007), the students were allowed to nominate up to five classmates whom they considered as friends.

The second method, *Social Cognitive Mapping (SCM)*, originally developed by Cairns, Perrin and Cairns (in Gest et al. 2003) asks children to identify as many social clusters in the classroom as they can recall, and has proven to be a valuable approach in identifying peer groups (Gest et al. 2003). The method is considered valuable, since children are expert observers of their entire peer social network. Most children can describe the composition of several social clusters, not just the one in which they participate (Gest et al. 2003). In our study, students were asked: "Does your class have groups of children who hang out together a lot? Who are they?" The children were allowed to name as many groups as they could recall and to include themselves in one or more groups.

2.4 Procedure

For both the reciprocal nomination method and SCM, a group-administered procedure was chosen. Students completed both the questionnaire on nomination and the one on SCM in a group setting. It was envisaged that students completing the first questionnaire might go through a process of thinking about friendships, resulting in a more elaborate completion of the second questionnaire. In order to prevent such order effects, the students in five classes were first asked to nominate their best friends, after which they were asked to name peer groups in class. In the remaining four classes the procedure was reversed: students started with SCM and ended with the reciprocal nomination method.

2.5 Analyses

2.5.1 Order effect

In the first five classes, students started with the reciprocal nomination method and ended with SCM. In the remaining four classes, the procedure was reversed. In order to assess a possible order effect, *t* tests on the average number of friends were applied.

2.5.2 Reciprocal nomination

The data resulting from the reciprocal friendship nomination method were analyzed using UCINET software (Borgatti et al. 1999) to identify friendships and NEGOPY 4.30 software (Richards 1995) to identify subgroups and isolated students in the classroom. Friendship was defined as a reciprocal choice, implying that two students chose each other as best friends (Frostdad and Pijl 2007). A cohesive subgroup in the classroom was defined as at least three students who have more links with members of the group than with non-members, are connected by some path to each of the group members and remain connected when up to 10% of the group is removed (Richards 1995). Two types of isolated students can be identified. An isolate Type 1, defined as a student with no reciprocated links at all, and an isolate Type 2, characterized as a person with one reciprocated link. The latter is regarded as isolate because the student depends on that one link, which makes his/her position vulnerable. NEGOPY provides a visual representation of the relations in the class. It maps the nominations for all children within the class by means of arrows and helps identify various groups of students, especially the popular and the isolated ones (Smith 2004).

2.5.3 Social cognitive mapping

Students' answers to the SCM questionnaire were analyzed using SCM 4.0 software (Leung 1998). This program generates a co-occurrence matrix, which lists all the students in a class on both axes (Xie et al. 1999). Each off-diagonal cell in the matrix indicates the number of times two students were nominated in the same group. Each diagonal number represents the total number of occasions that a given student was named as belonging to any group. The distribution of numbers in a column is regarded as the personal profile of co-occurrences with other students in the same groups (Xie et al. 1999). Based on the co-occurrence matrix a correlation matrix is then generated by intercorrelating the columns in the co-occurrence matrix. The correlation coefficients in this matrix show the degree to which students agreed about the composition of the various groups of friends. On that basis it can be determined which students are part of which group(s) of friends and which students are not part of any group. Based on the recommendation of Cairns et al. (in Xie et al. 1999), a cut-off point of .40 for the correlation was used to determine whether two students were in the same subgroup. A correlation larger than .40 suggests that two students participate in the same subgroup, a correlation below .40 is interpreted as two students not belonging to the same subgroup. The correlation matrix of each class can be represented graphically, visualizing the network structures in each class (Kindermann 1993).

The outcomes of both methods will be compared. A comparison will be made between number of friends, number of isolates, number of cohesive subgroups and the graphical representations of both methods denoting the social structure of the classes involved in the study. Based on literature (e.g. Chambers and Kay 1992) it is expected that the nomination method will yield less positive outcomes, resulting in more isolated students, fewer friendships and more students not belonging to a cohesive subgroup.

After all data had been analyzed, the schools were visited once more. The graphic representations of both methods were discussed with the class teacher and three

students from each class. In consultation with the teacher, three students were selected who were expected to have the best view on social relations within the class, and who would treat the outcomes discreetly. Independent of each other, teachers and students were asked which graphic representation reflected reality best.

3 Results

3.1 Order effect

Completion of the first of the questionnaires could have triggered a process of reflection on friendships, resulting in a more elaborated completion of the second questionnaire. This could yield a higher average number of friends on the questionnaire presented as second. In order to check for possible order effects, the average number of friends for both methods and both orders was calculated and t tests for independent samples applied. The data showed that the average number of friends did not differ significantly for both orders when based on either SCM (SCM first, $M = 4.26$, $SD = 0.93$; SCM second, $M = 3.63$, $SD = 0.69$; $t(7) = 1.14$, $p = 0.29$) or the nomination method (nomination first, $M = 2.98$, $SD = 0.08$; nomination second, $M = 3.05$, $SD = 0.17$; $t(7) = -0.80$, $p = 0.45$). This showed that order effects were absent.

3.2 Number of friends and isolates

The number of friendships of each of the students based on SCM was compared to the number of friendships based on the nomination method. Table 1 presents the outcomes for both methods (horizontally for nomination and vertically for SCM).

In analyzing Table 1, the data on the diagonal (from upper left to lower right) are relevant, as they represent the corresponding outcomes. For 56 of the 190 students (29.5%), the SCM and nomination outcomes were similar regarding students' number of friends. The data under the diagonal show that, compared to the nomination outcomes, SCM outcomes were more positive regarding students' number of friendships

Table 1 Number of friendships on the basis of nomination method and SCM

SCM	Nomination						Total
	0	1	2	3	4	5	
0	0	0	0	0	0	0	0
1	1	6	5	4	1	1	18
2	5	6	8	4	6	1	30
3	1	2	5	4	4	3	19
4	2	5	5	15	15	5	47
≥ 5	2	2	9	27	13	23	76
Total	11	21	32	54	39	33	190

for 100 students (52.6%). In other words, for them the number of friends when based on SCM was higher compared to the nomination method.

The data above the diagonal show that for 34 students (17.9%) the number of friends based on the nomination method was higher than the number based on SCM. A remarkable finding was that, according to SCM, all students had at least one friend, yet according to the nomination method, 11 students had no friends at all. The data on the diagonal and those close to it show that the number of friends according to both methods corresponded fairly. As an index of agreement, Gower's coefficient (Gower 1971) was calculated, which was 0.74. This indicated a reasonably high agreement between the outcomes of both methods.

A problem in comparing numbers of friends with the two methods was that the nomination method works with a maximum number of friends (five). In SCM this number is not fixed beforehand, but results from the analyses. In order to be able to compare both methods, all students with five or more friends according to SCM were combined into one category. The fifth row in Table 1 comprises this same combination (≥ 5) according to SCM. This introduces some error in the table and is therefore likely that the Gower coefficient is an underestimate of the actual relation between both datasets.

3.3 Number of cohesive subgroups

A second comparison concerned the number of groups of friends in each classroom. With the SCM method, the minimum number of students in a group is two, whereas according to the nomination method, a group consists of at least three students. When two students are only connected to each other, this is called a dyad according to this same method.

As shown in Table 2, SCM distinguished more groups of friends than the nomination method in eight out of nine classes. In Class 2, the number of groups of friends was the same for both methods. In order to examine if the average number of groups of friends differed significantly for the two methods, a *t* test for dependent samples was applied. It turned out that the average number of groups of friends based on SCM ($M = 4.98$, $SD = 1.27$) was significantly higher than the average number (including dyads) based on the nomination method ($M = 3.11$, $SD = 0.78$, $t(8) = 3.83$, $p < 0.05$).

3.4 Composition of cohesive subgroups

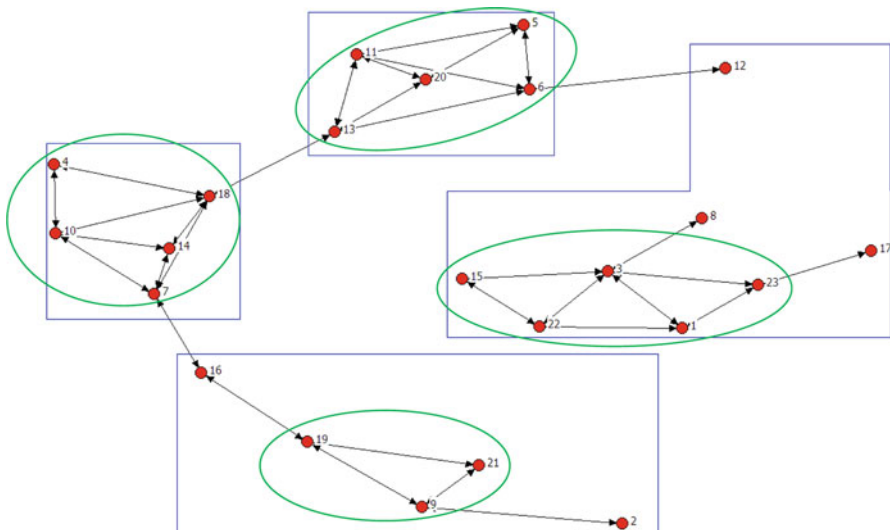
Next to the analyses described above, the group structures as defined by SCM were compared to the structures as defined by the nomination method. For four out of nine classes, the group structures as defined by SCM were largely or completely similar to the structures as defined by the nomination method. For the other five classes, the SCM graphic representation divided the graphic representations of the nomination method into smaller groups. As it would take up too much space here to show the group structures of all nine classes, only the structures of two classes are shown. Figure 1 shows an example of a class for which the group structures as defined by

Table 2 Number of groups of friends and dyads on the basis of SCM and nomination method

	SCM	Nomination	
	Number of groups	Number of groups	Number of dyads
Class 1	5	2	0
Class 2	4	4	0
Class 3	6	2	1
Class 4	7	2	1
Class 5	3	2	0
Class 6	5	3	0
Class 7	4	3	1
Class 8	4	2	1
Class 9	6	4	0

both methods present much similarity. Figure 2 shows an example of a class for which the SCM graphic representation divides the graphic representation of the nomination method into smaller groups.

Figure 1 shows the outcomes for Class 2. The arrows present the mutual relations between students based on the nomination method, while the round circles represent the groups of friends based on this same method. The square blocks represent SCM outcomes. For class 2, almost all groups as defined by SCM were also defined by the nomination method. As can be seen at the top of Fig. 1, students 5, 6, 11, 13 and 20 constitute a cohesive subgroup according to both methods, as do students 4, 7, 10, 14

**Fig. 1** Graphic representation of nomination and SCM for class 2 ($n = 23$)

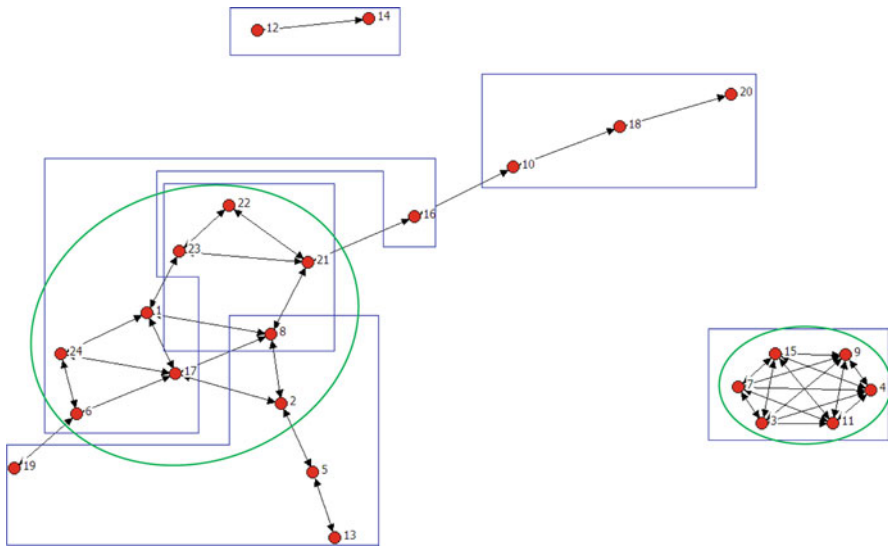


Fig. 2 Graphic representation of nomination and SCM for class 3 ($n = 24$)

and 18 (left of Fig. 1). The only difference between the SCM and nomination outcomes for this class was that the nomination method defined four students (2, 8, 12, 17) as isolate type 2 (having one reciprocated link), whereas SCM regarded them as group members. In addition, student 16 was regarded as a group member by SCM, whereas the nomination method regarded this student as linking two groups but without being part of a group.

Figure 2 shows the outcomes of a class (class 3) for which the SCM graphical representation divided the graphic representation of the nomination method into smaller groups. As can be seen in the figure, neither method found students who were totally isolated. However, three students (13, 19 and 20) were labeled as an isolate type 2 according to the nomination method, whereas they had relations with one or more classmates according to SCM. SCM also placed students 16 and 19 in groups with students with whom they had no direct connections according to the nomination method.

None of the nine group structures as formed by SCM had isolated students, which implies that all students were part of one or more groups of friends. This stands in contrast to the nomination method, in which eight out of nine classes labeled one or more students as being isolated. More specifically, in six out of nine classes there was at least one totally isolated student (having no friends at all), whereas in eight out of nine classes there was at least one student who was called an isolate type 2. In total, 11 students (5.8%) were called an isolate type 1, and 13 students (6.8%) an isolate type 2. All of these students were part of a group of friends, according to SCM.

3.5 Face validity of SCM and nomination method outcomes

The graphic representations of each class was discussed with the teachers and three students per class. Following the teacher's request, in two classes only two students

were involved in assessing the outcomes. In total, 9 teachers and 25 students assessed these outcomes. It turned out that for teachers and students it was quite hard to decide which representation fitted best with reality. One teacher and two students believed that the graphic representations of both methods reflected reality equally well. A small majority of students (15 out of 25), however, considered that the group structures as formed by SCM best reflected reality. The other eight students considered the graphic representation of the nomination method to be the best reflection of reality, as did more than half of the teachers (5 out of 9). Three teachers thought the SCM outcomes best fitted the social structure of the class.

Teachers and students mentioned several advantages and disadvantages of both methods. A number of teachers regarded the graphic representation of SCM as more convenient than that of the nomination method. A frequently mentioned advantage of the group structure based on the nomination method was that it provided more specific and additional information than SCM. One complaint was that some links in the nomination structure seemed to be at odds. According to both teachers and students there were links between students who were not friends, or links lacking between students who, in their view, were friends.

3.6 Post hoc analysis

As described above, according to SCM all 190 students in the nine classes had at least one friend and were part of one or more groups of friends. This outcome is quite surprising, as it is known from the literature that about 4–10% of children do not have friends in primary classrooms (Doll 1996). For instance, Frostad and Pijl (2007) found that 4.9% of typically developing Norwegian students in the fourth grade and 7.5% of seventh-grade typical students did not have friends at all. It might be that the cut-off point of .40, used as default value in SCM to determine whether two students are in the same subgroup, is too low and should be more stringent. In a post hoc analysis, the effects of using another cut-off point were established. It was decided to deviate clearly from .40 as cut-off point. As an experiment .70 was chosen as a new cut-off point. In accordance with the first analysis, the outcomes of SCM and the nomination method were compared. Table 3 presents the outcomes for SCM (vertically) and the nomination method (horizontally).

The data on the diagonal show that for almost one-third of students ($n = 61$, 32.1%), the SCM and nomination outcomes were similar regarding students' number of friends. The data under the diagonal show that for 38 students (20.0%) SCM outcomes were more positive regarding students' number of friendships, than were nomination ones. The data above the diagonal show that for almost half of the students ($n = 91$, 47.9%) the number of friends based on the nomination method was higher than the number of friends based on SCM. In addition, the number of students having no friends at all was higher according to SCM ($n = 14$) than to the nomination method ($n = 11$). The data show that the number of friends assessed on the basis of the two methods corresponded fairly. Gower's coefficient was 0.76, which indicates a reasonably high agreement between the outcomes of SCM and the nomination method. Compared to

Table 3 Number of friendships on the basis of nomination method and SCM (0.7)

SCM	Nomination						Total
	0	1	2	3	4	5	
0	4	0	4	2	3	1	14
1	3	9	10	12	7	3	44
2	3	9	9	13	5	3	42
3	0	0	5	20	13	9	47
4	1	3	1	4	8	6	23
≥ 5	0	0	3	3	3	11	20
Total	11	21	32	54	39	33	190

the initial analysis with the cut-off point of .40, there was a slight improvement of correspondence.

Compared to the outcomes of the initial analysis (see Table 1), the percentage of corresponding outcomes between SCM and the nomination method was slightly higher for the outcomes of the post hoc analysis (32.1% vs. 29.5%). In addition, the initial analyses showed that for more than half of the students, the SCM outcomes were more positive compared to the nomination outcomes. In the post hoc analysis, SCM outcomes were more positive for only one-fifth of the students, and for almost half of the students the nomination outcomes were (slightly) more positive. Finally, the initial analysis revealed that, according to SCM, all students had at least one friend, whereas the post hoc analysis revealed that the number of students having no friends at all was 14. This latter number is more in line with the 11 students who were labeled according to the nomination method.

4 Discussion

This study addresses the question of whether the frequently-used reciprocal nomination method provides realistic outcomes on students' number of friends and friendship networks in regular elementary school classrooms. To answer this question, data were gathered by using the reciprocal nomination method and by applying an alternative method: Social Cognitive Mapping (SCM). A comparison of the data gathered with the two methods showed that based on the reciprocal nomination method, students have slightly fewer friends, on average, and are labeled as "isolated" more often. These differences are rather modest, and the same applies for the differences in group structures. In five school classes, SCM divided the group structure and composition made by the nomination method into a larger number of smaller groups, and in four classes the methods virtually overlapped.

After collecting and analyzing the data, the class teachers and two or three students per class were invited to comment on the group structure and composition as defined by both methods. A small majority of the students regarded the group structure of SCM as best reflecting reality, whereas more than half of the teachers considered the

group structure based on the nomination method as a good representation of friendship networks in class.

This study was triggered by statements in literature that the nomination technique provides too negative a picture of friendship relations in class. The outcomes of this study do not support this statement. It is true that the outcomes based on the nomination procedure tend to yield a somewhat more negative representation compared to the SCM-based outcomes, but on the whole the methods do not differ that much.

The small differences between the methods could be explained by their different procedures for data gathering. However, it could also come down to the choice of a few default values in the data gathering and analyses of both methods. The nomination procedures, for example, worked with a maximum of five friends and, in some cases, defined students with one friend as isolated (isolates type 2). In social cognitive mapping, a cut-off point of .40 was used to decide whether two students were in the same group. The post-hoc analysis was meant to find out if small changes in one or more of these default values would result in slightly different outcomes. As an experiment, the default value for the SCM cut-off point of .40 was set at .70, which meant that the requirements for regarding two students as members of the same group were more stringent. The decision to use .70 as new cut-off point was an arbitrary choice, .60 would most likely have done the job as well. Analyzing the data with a higher cut-off point reduced the number of students with one or more friends. An immediate result was that the overlap in number of friends as described by both methods was enhanced. This suggests that any possibly more negative or positive description of friendship networks in class has more to do with the setting of a few default values than with fundamental differences between these two methods.

This conclusion is based on a rather small scale study using data from one region, with students from a limited age range and manipulation of only one variable in a post-hoc analysis. It was further based on data collection with typical students in regular schools. The results based on data gathering with other groups of students, i.e. special needs, could yield more negative results. These limitations restrict generalizing the outcomes.

The study was originally meant to simply describe the differences between two methods for the description of friendship networks. Only in the course of the study did the idea arise that the degree of overlap between the outcomes of the two methods could be directly related to a few standard settings in data gathering and analyses. At that stage only one of those settings could be manipulated. Replication of the study with a higher maximum number of friends in the nomination procedure, a larger number of classes and teachers, a wider age range and using a third method could enhance our knowledge about the overlap between the different procedures to describe friendship networks.

As long as this knowledge is not available, the practical question remains as to which of the two procedures is the preferred one to describe friendship networks. The user-friendliness of the nomination procedure, the quick ten-minute data gathering in class, and the use of only positive questions can be regarded as strong advantages. SCM is more complicated, more time-consuming and focuses more on naming isolated students. This raises issues about the ethics of this method of describing friendships and friendship networks in class. The teachers and the students participating in this

study thought differently about the face validity of the outcome of both methods, but these differences were small.

In conclusion, the outcomes of both methods do not differ that much. Differences between the outcomes can largely be explained by a few standard default values in data gathering and data analyses. Pushing some other buttons will immediately produce (slightly) other results. Having said that, it urges the user of these methods to interpret the outcomes of such methods with caution.

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